III. AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes changes to Figure 6. This sheet, which includes Figure 6, replaces the Replacement Sheet including Figure 6 that was filed on August 27, 2004. In Figure 6, the character reference "50" has been added.

Attachment: One Replacement Sheet

One Annotated Sheet Showing Changes

IV. REMARKS

The Examiner objects to claims 3 and 4 on the grounds that "the number of nozzles in a membrane section of 500 μm^{2}" is not supported by the specification, which requires a nozzle of a larger diameter, such as 17 μm, in order to handle fluid with a high density, such as 7 cps (Office Action, dated March 15, 2006, at 2, lines 1-7). The Examiner's contention is incorrect because, as described on page 14, line 25, to page 26, line 9, a high nozzle density is important, in accordance with certain embodiments of the present invention, for providing a low-cost device. While Applicants' specification teaches that the choice of nozzle diameter for a given application depends upon the viscosity of the liquid, such that for liquids of high viscosity a larger nozzle diameter is preferred (Applicants' specification, page 13, line 24, to page 14, line 4), Applicants' specification does not preclude employment of smaller nozzle diameters for use with less viscous fluids. On the contrary, Applicants' specification clearly contemplates the use of high nozzle density (due to small nozzle diameters) in low cost embodiments of the invention (Applicants' specification, page 14, line 25, to page 26, line 9).

The drawings have been amended to add character reference "50" in Figure 6 to designate the leak-tight membrane described on page 11, lines 2-5, of the specification and shown in the original drawings. The specification has been amended in accordance with the change to the drawings.

Claims 1 and 9 have been amended to improve grammar and/or to delete extraneous punctuation. The present amendment has no limiting effect on the scope of the claims and was not made for any reason related to patentability. Claim 6 has been amended to recite "said first and second substrates are formed integrally from one substrate by machining" as supported on page 10, lines 7-12, of the specification as originally filed.

New claim 11, which depends upon claim 10, has been added, and recites "said vibrating element is a piezoelectric element" as supported on page 11, lines 26-28, of the specification as originally filed.

The present amendment adds no new matter to the application.

A. The Invention

The present invention pertains broadly to a nozzle body for a liquid stray device for nebulizing a high-viscous liquid substance, such as may be used to nebulize functional liquids, medications, sanitizers, and/or fragrances and the like. In accordance with an embodiment of the present invention, a nozzle body for a liquid spray device for nebulizing a high-viscous liquid substance is provided that includes the features recited by independent claim 1. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage of the various embodiments of the present invention is that a nozzle body is provided so that "each nozzle output channel is step-shaped with a wider portion adjacent said space and a thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section." This structure prevents wetting of the nozzle membrane surface when higher nozzle densities are employed to nebulize liquids of greater viscosity.

B. The Rejections

Claims 1 and 9 stand rejected under 35 U.S.C. § 102(b) as anticipated by Hess et al. (EP 1 273 355 A1, hereafter, the "Hess'355 Document").

Claim 2 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Silverbrook (U.S. Patent 6,669,333 B1, hereafter the "Silverbrook

Patent"). Claims 3 and 4 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document. Claim 5 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Adachi et al. (U.S. Patent Application Publication 2002/0158952 A1, hereafter the "Adachi'952 Publication"). Claim 6 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Koto (U.S. Patent 4,434,430, hereafter the "Koto Patent"). Claim 7 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Hartmann (U.S. Patent Application Publication 2003/0085966 A1, hereafter the "Hartmann Publication"). Claim 8 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Koizumi et al. (U.S. Patent 5,900,894, hereafter the "Koizumi Patent"). Claim 10 stands rejected under 35 U.S.C. § 103(a) as unpatentable over the Hess'355 Document in view of Adachi et al. (U.S. Patent Application Publication 2003/0107159 A1, hereafter the Adachi'159 Publication).

Applicants respectfully traverse the Examiner's rejections and request reconsideration of the above-captioned application for the following reasons.

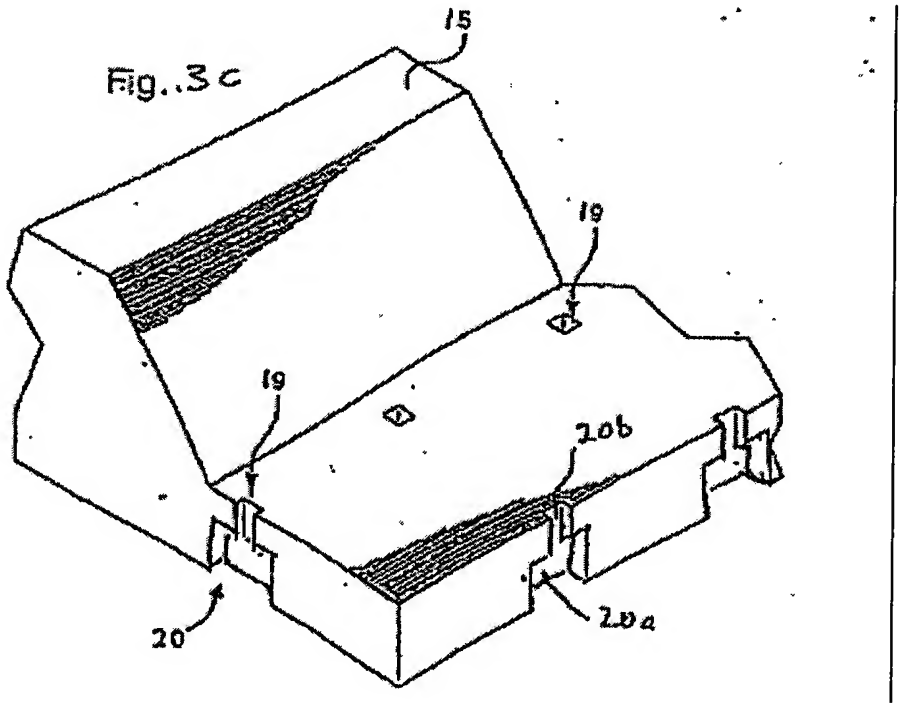
C. Applicants' Arguments

Anticipation under 35 U.S.C. § 102 requires showing the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). In this case, the Hess'355 Document fails to teach each and every limitation of independent claim 1; therefore, the Examiner has not established a prima facie case of anticipation against the instant claims.

i. <u>The Hess'355 Document</u>

The Hess'355 Document teaches a "method of manufacturing a liquid droplet spray device and such spray device," wherein a liquid droplet spray device, as shown in Figures 3a, 3b, 3c, is manufactured so as to include a first substrate (15), a space (12) within the housing for containing the supplied liquid substance, and outlet means arranged in the first substrate (15) and including outlet nozzles (19) and stepped output channels (20). As shown in Figure 3c, the output channels (20) have straight side walls with a lower portion (20a) and an upper portion (20b). As also shown in Figure 3c, the lower portion (20a) is adjacent to the space (12) and is larger in diameter than the upper portion (20b). The Hess'355 Document also teaches that there is a vibrating element (18) for vibrating liquid so as to eject it (See Abstract).

However, it is plain from Figure 3c, reproduced below, that the device taught by the Hess'355 Document does not include a "thinner portion containing <u>a protrusion section</u> protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.



The "protrusion section" recited in independent claim 1 serves to prevent wetting of the nozzle membrane surface, which occurs when high nozzle density is employed to nebulize more viscous liquids. This wetting phenomenon occurs due to the surface capillarity of the more viscous liquids. The "protrusion section," which is "at a substantially straight angle with respect to the top surface of said nozzle membrane" serves an important function in accordance with the present invention.

The reason high nozzle densities are employed, in accordance with the present invention, is to increase flow rate of the nebulized liquid, not to create a higher quality printed image. Increased flow rate may be increased in two ways: (1) more nozzles increase flow area and, thus, flow rate, and (2) increased nozzle density (i.e., more nozzles/surface unit) results in formation of larger droplets, which results in higher flow. For inkjet printers, such as is the subject matter of the Silverbrook Patent (which is discussed below), larger droplets would be disastrous for the quality of a printed image as would be appreciated by those of ordinary skill in the art. For inkjet printing technology, nozzle density helps to increase the dots per square inch; however, subject to the limitation of one chamber per nozzle.

For all of the above reasons, the Hess'355 Document fails to establish a prima facie case of anticipation against claim 1 of the present application.

ii. The Section 103 Rejections

A prima facie case of obviousness requires a showing that the prior art teaches each and every element of the claimed invention, and that the prior art provides some teaching, suggestion or motivation to combine the references to produce the claimed invention. In re Oetiker, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992); In re Vaeck, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). In this case, the remaining documents fail to teach, or suggest, the "thinner portion

containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1; therefore, all combinations of teachings from these documents fail to establish a prima facie case of obviousness against the instant claims.

iii. The Hess'355 Document

The Hess'355 Document is discussed above. As admitted by the Examiner, the Hess'355 Document does not teach, or suggest, the subject matter of claims 2-8 and 10 (Office Action, dated March 15, 2005, at 4, lines 13, to at 7, line 18). With respect to claims 3 and 4, the Examiner contends that it would have been obvious to a person of ordinary skill in the art to discover the optimum value of a result effective variable, such as the nozzle density per area, and cites In re Boesch, 205 U.S.P.Q. 215 (C.C.P.A. 1980) in support of this contention (Office Action, dated March 15, 2006, at 5, lines 1-10). However, the Examiner has misapplied Boesch to this case.

In Boesch, 205 U.S.P.Q. at 216-218, the invention was a nickel base alloy and the prior art patent taught alloy composition tables. The court concluded that, because the compositions taught by the prior art overlapped the compositions of the claims, that it would have been obvious to discover the optimum value of the electron hole number (Nv) in order to avoid embrittling metal phases (i.e., the sigma phase). Boesch, 205 U.S.P.Q. at 219.

In this case, there is no overlap between the nozzle density taught by the Hess'355 Document and the nozzle density as claimed in claims 3 and 4. For this reason alone, the rule of Boesch does not apply. Furthermore, the Examiner has not shown, based on prior art, that increasing nozzle density would improve the ability of the liquid droplet spray device of the Hess'355 Document to print high definition pictures as the Examiner contends (Office Action, dated March 15, 2006, at 5, lines 4-8). On the contrary, the liquid spray device taught by the Hess'355 Document is a nebulizer/atomiser, and not a device for printing

images. Therefore, the Examiner has not established a reason to increase nozzle density with respect to the device taught by the Hess'355 Document. Consequently, the Section 103 rejection standing against claims 3 and 4 should be withdrawn.

iv. The Silverbrook Patent

The Silverbrook Patent teaches "stacked heater elements in a thermal ink jet printhead," as shown in Figure 1, wherein a unit cell (1) of a printhead includes a nozzle plate (2), a nozzle (3) having nozzle rim (4) and aperture (5) extending through the nozzle plate (2). When the printhead is in use, the device taught by the Silverbrook Patent uses a heater element (10) to give a thermal pulse to ink that has flowed from a reservoir (not shown) to chamber (7) via inlet passage (9) to fill the chamber to a predetermined level (col. 5, lines 33-42). However, the Silverbrook Patent does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

The Silverbrook Patent teaches one nozzle (3) per unit cell (1) as shown in Figure 1. The Hess'355 Document teaches multiple outlet nozzles (19) per substrate (15). Therefore, a person of ordinary skill in the art would have no reason to combine the Silverbrook Patent with the Hess'355 Document as the Examiner has done. As discussed above, increased nozzle density in the context of an "array of outlet nozzles" connected to one "enclosed space," as recited in claim 1, increases flow rate by generating larger droplets, which would diminish the quality of a printed image. Consequently, a person of ordinary skill in the art would have no reason to combine the teachings of the Silverbrook Patent with those of the Hess'355 Document.

v. The Adachi'952 Publication

The Adachi'952 Publication teaches "ink for ink jet recording and inkjet recording method," wherein the ink has a viscosity of "preferably 30 mPas or less...more preferably 30 mPas" (paragraph [0073]). A person of ordinary skill in the art would realize that the Adachi'952 Publication teaches ink viscosity around 30 mPas. The Adachi'952 Publication does not teach, or suggest, viscosity of a liquid substance "of at least 5 mPas" as recited by claim 5. The Adachi'952 Publication also does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

vi. The Koto Patent

The Koto Patent teaches an "ink jet printer head" that includes first and second substrates coupled together to form one nozzle, pressure chamber and passageway (See Claim 6). A person of ordinary skill in the art would realize that this coupling of two substrates requires some form of bonding, gluing or welding, which does not meet the limitation of claim 6 "wherein said first and second substrates are formed integrally from one substrate by machining." The Koto Patent also does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

vii. The Hartmann Publication

The Hartman Publication teaches "reserve ink supply in thermal ink jet cartridge ink tanks" wherein, as shown in Figure 1, an ink cartridge includes a foam chamber (12) for storing a porous member such as a foam material or compressed porous material impregnated

with ink (paragraph [0024]). However, the Hartman Publication does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

viii. The Koizumi Patent

The Koizumi Patent teaches "ink jet print head, method for manufacturing the same, and ink jet recording device" that uses a seal material (46), made of silicone (col. 14, line 18, to col. 15, line 10). As evident from Figures 12E and 14A, the seal material (46) does not form a "flexible but leak-tight separation" as recited in claim 8 of the present application. The Koizumi Patent simply does not teach, or even suggest, that its silicon seal (46) is flexible. On the contrary, a person of ordinary skill in the art would recognize that the seal (46) would be rigid and not flexible.

The Koizumi Patent also does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

ix. The Adachi'159 Publication

The Adachi'159 Publication teaches a "bonding method" wherein a vibration plate (32) is molded with an ink chamber (31) using molds (31') and (32'), (paragraph [0057]). The Adachi'159 Publication is completely silent with respect to a "vibrating element...attached to said nozzle body through removable attachment means" as recited in claim 10. The vibration plate taught by the Adachi'159 Publication is neither a "vibrating element" as recited in claim 10 nor a "piezoelectric element" as recited in claim 11. Also, because the vibration plate (32) is molded into place as taught by the Adachi'159 Publication,

the vibration plate (32) is not attached to a "nozzle body through removable attachment means" as recited in claim 10.

The Adachi'159 Publication also does not teach, or suggest, a "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

In sum, neither the Hess'355 Document, the Silverbrook Patent, the Adachi'952 Publication, the Koto Patent, the Hartmann Publication, the Koizumi Patent, nor the Adachi'159 Publication teach, or suggest, the "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1. Therefore, the Examiner has not established either a prima facie case of anticipation or a prima facie case of obviousness against the instant claims.

Furthermore, the Examiner has misconstrued the teachings of (i) the Adachi'952 Publication, which does not teach the recited viscosity "of at least 5 mPas" recited by claim 5, (ii) the Koto Patent, which does not teach first and second substrates "formed integrally from one substrate by machining" as recited by claim 6, (iii) the Koizumi Patent, which does not teach "a flexible but leak-tight separation" as recited in claim 8, and (iv) the Adachi'159 Publication, which does not teach a "vibrating element...attached to said nozzle body through removable attachment means" as recited in claim 10.

Also, the teachings of the Silverbrook Patent, which relate to an inkjet printer head, are not combinable with those of the Hess'355 Document, which relates to liquid droplet spray device for nebulizing liquids, because inkjet printers employ one nozzle per ink chamber, whereas the device of the Hess'355 Document employs an array of nozzles per liquid chamber, and because the technology employed by the Hess'355 Document would diminish the quality of images produced by an inkjet printer.

V. CONCLUSION

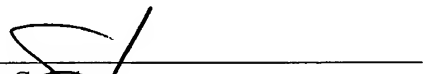
The Examiner has not established either a prima facie case of anticipation or a prima facie case of obviousness against claims 1-11 of the present application because neither the Hess'355 Document, the Silverbrook Patent, the Adachi'952 Publication, the Koto Patent, the Hartmann Publication, the Koizumi Patent, nor the Adachi'159 Publication teach, or suggest, the "thinner portion containing a protrusion section protruding beyond the top surface of said nozzle membrane section" as recited by independent claim 1.

For all of the above reasons, claims 1-11 are in condition for allowance and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below-signed attorney for Applicants.

Respectfully submitted,

GRIFFIN & SZIPL, P.C.



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